

Photonics in Dentistry

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New optical diagnostic tools utilizing near-IR light hold considerable promise for the early detection and diagnosis of dental caries. Pulsed lasers are ideally suited for the conservative removal and modification of sound and carious dental hard tissues and for the selective removal of composite. Although there have been significant gains in reducing the incidence of dental caries (tooth decay), it remains the principal cause of tooth loss in the U.S. A new approach towards the treatment of dental caries is advocated with an emphasis on early detection and monitoring followed by minimal intervention. At UCSF we are developing new near-IR based optical diagnostic tools for the detection and characterization of these caries lesions in the early stages of development. These tools include near-IR imaging and polarization sensitive-optical coherence tomography (PS-OCT). Lasers are also ideally suited for conservative intervention, since laser light can be precisely focused to preferentially ablate carious tissue. Moreover, laser radiation vaporizes water and protein and changes the chemical composition of the remaining mineral phase of enamel and dentin, thus decreasing the solubility to acids around the periphery of the restoration site to leave a smooth surface with an enhanced resistance to secondary decay. Lasers induce less pain, noise and vibrations and are less likely to require anesthesia. Therefore they are advantageous for treating children, and patients with dental phobias. Other novel applications of lasers include the selective removal of composite sealants and restorations and the processing of bone without peripheral thermal damage. This research was supported by the NIH and the DOE.